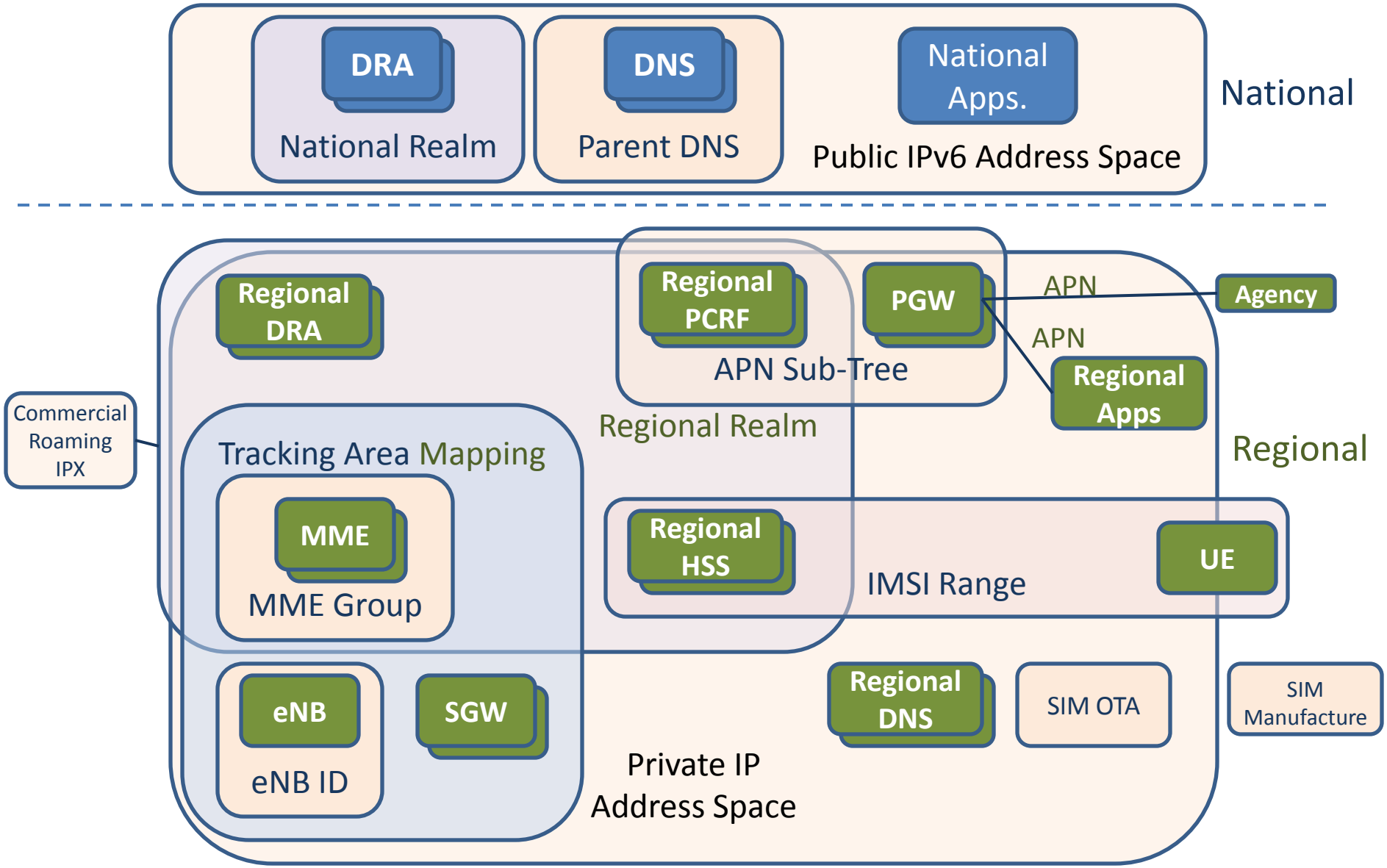
National/Regional PS Network ID Planning

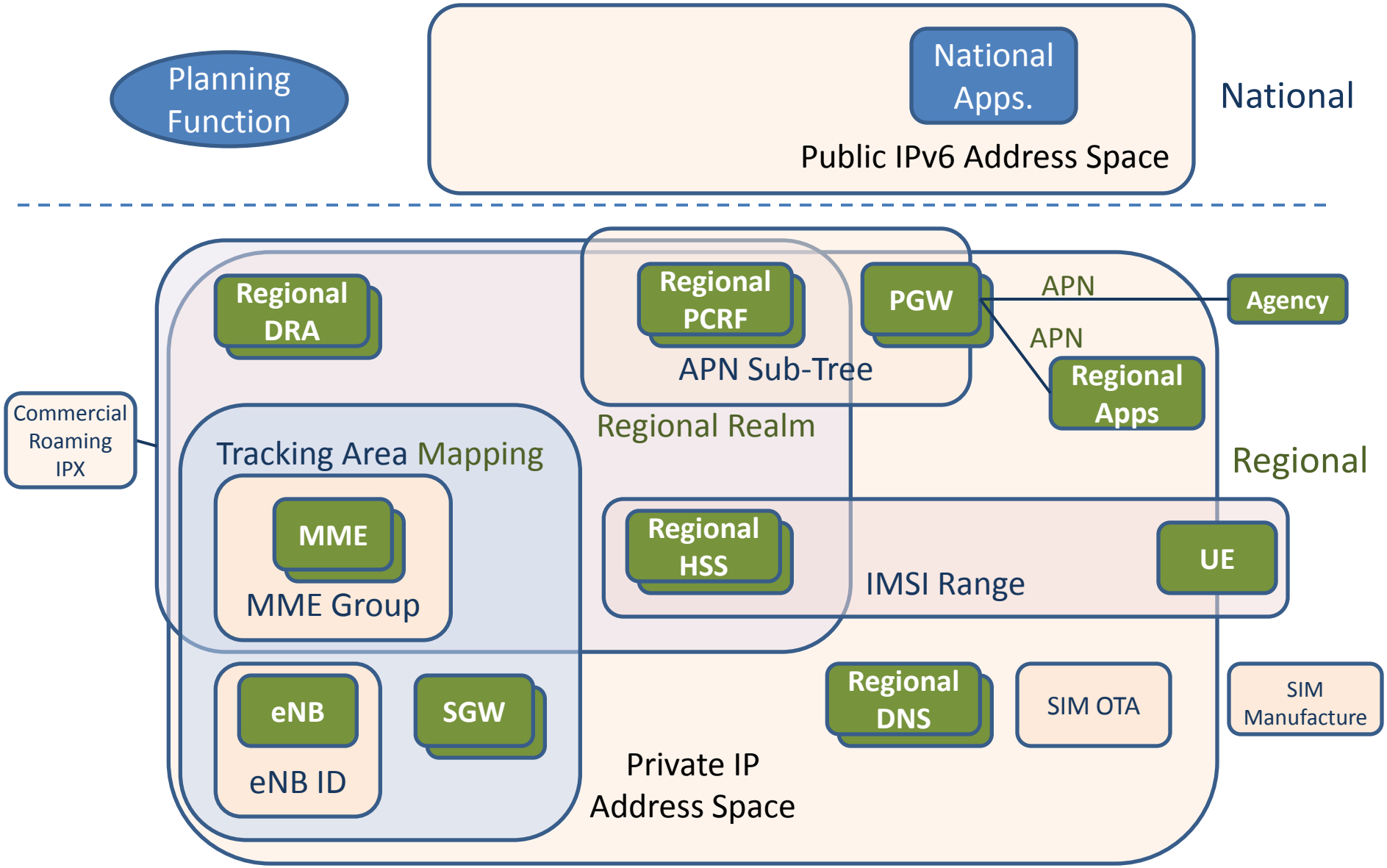
Assumptions

- National Entity
  - Overall network operator – owns PLMN
  - Controls planning and distribution of ID's derived from PLMN
  - Authorizes regional entities to participate in the network
- Regional Entity
  - Operates majority of the network equipment with in the scope allocated by the national entity
  - Assigns ID's to physical equipment within its domain
  - Provides local control without breaking inter-operability
  - Works with adjacent regional entities to do coordinated network planning (cell locations, system inter-connects, …)
- Phased approach required to enable waiver deployments
  - Identify long term target architecture
  - Identify interim build-out architecture

National/Regional Split (Long Term Target)



National/Regional Split (Interim Build-out)



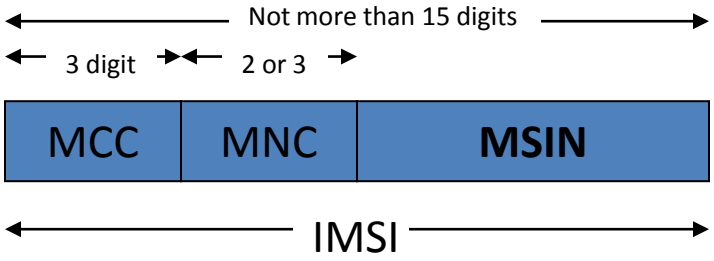
National Entity - Common ID Management

- National PLMN
- National DIAMETER realm (long term target)
  - National DRA infrastructure for roaming interfaces
  - Mapping to Regional Realms based on IMSI ranges
- Parent DNS (long term target)
  - National DNS infrastructure for roaming interfaces
  - Central authoritative name server maps to each regional DNS

Nationally Managed, Regionally Distributed IDs

- MSIN component of International Mobile Subscriber Identity (IMSI)
- Access Point Name (APN) Network Identifier
- Mobility Manager Entity Group Identifier (MMEGI)
- Tracking Area Codes (TAC)
- eNodeB Identifiers (ECI, eNB-Id)

MSIN



Mobile Country Code (MCC)

Mobile Network Code (MNC)

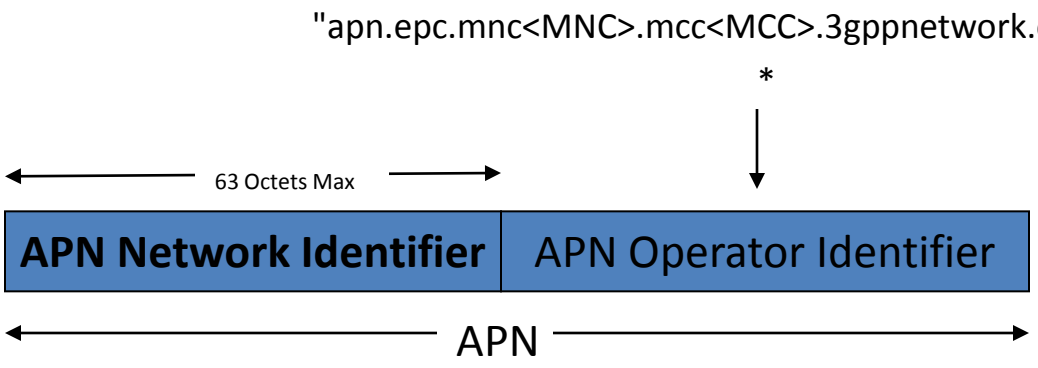
Mobile Subscriber Identification Number (MSIN)

International Mobile Subscriber Identity (IMSI) – uniquely identifies a SIM card for internal network use.

- MSIN's to distribute = 1B per PLMN
- **Suggest MSIN's be distributed in blocks of 100K ID's**
  - Contiguous blocks make for simpler DRA routing
  - Regional entities can be assigned multiple blocks
- ~2M first responders
  - usage of additional ID's as devices are replaced
  - machine to machine usage could lead to larger consumption of ID's

- Regional IMSI range allocated from national pool
  - Regional network provides local HSS(s)
    - Allows local control of subscriber provisioning without sacrificing any interoperability
    - Local subscriber provisioning within IMSI range(s) extended to agencies (access control to groups of users per agency)
  - Regional DRA (DIAMTER Routing Agents) support for routing to regional HSS(s)
    - IMSI range routing is generally available in infrastructure equipment. Since IMSI's are not exposed to the subscriber or their contact lists, there is no need for an ENUM like database lookup by the DRA to route to an HSS

APN Network Identifier



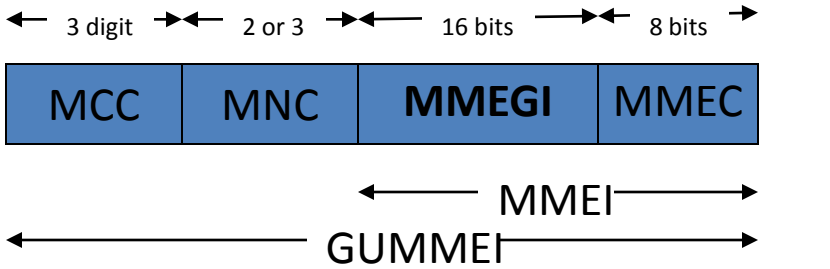
Access Point Name (APN) - used to identify a packet data network to connect the UE too.

- **Suggest starting APN with regional identifier or federal identifier registered with the national entity**
  - **Regional entity can choose remaining schema**
  - **Naming scheme for open APN's such as hosting status page needed nationally**

  i.e.
  "Region2.il.chicago.metropolice",
  "Region2.il.visitedaccess"

- Regional APN naming tree assigned by national operator
  - Regional entity provides APN entries in DNS (including host mappings, weight, priority) for regional APN's
  - PGW provisioning by regional entity to support regional APN set
  - National entity provides regional DRA support for regional PCRF(s) (including APN specific PCRF's)

MMEGI

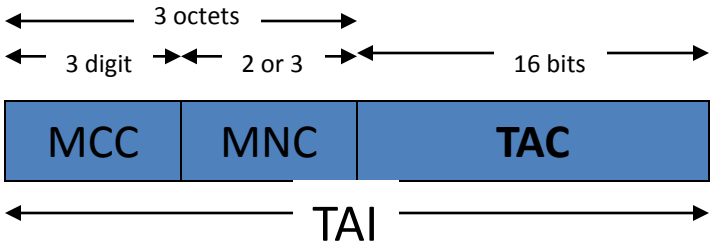


Globally Unique MME Identifier (GUMMEI)
MME Identifier (MMEI)
MME Group ID (MMEGI)
MME Code (MMEC)

- MMEGI's to distribute = 65,535
- **Suggest MMEGI's be given out as needed**
  - **Most regions will only need one**
  - **No need to give out blocks of ID's, they do not need to be contiguous**

- Regional MME Group Identifier allocated by national operator
  - Regional entity provides MME Code assignment
    - If MMEGI's are shared across regional operational boundaries then the MMEC's must also be nationally allocated.
  - Regional entity programs MME Group/MME Code DNS entries

Tracking Area Codes



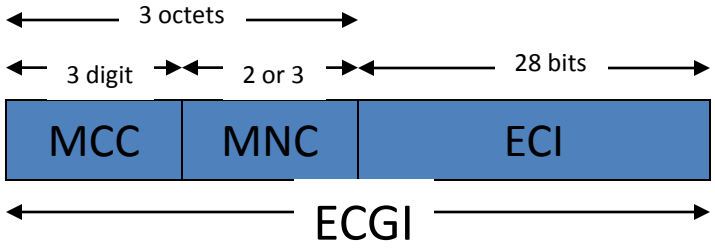
Tracking Area Identity (TAI)

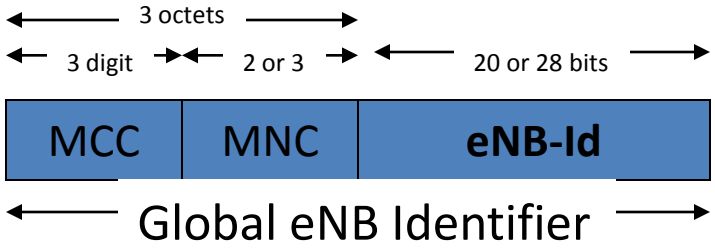
Tracking Area Code (TAC) – used for tracking UE location and for distribution of UE's across EPC equipment

- TAC's to distribute = 65,535
- **Suggest TAC's be given out in blocks of 256**
  - **Regions given blocks using a unique assignment of the eight most significant bits**
  - **Do not need to be contiguous**

- Regional Tracking Area Codes assigned by national operator
  - Regional entity provides Tracking Area to MMEGI mapping and associated DNS entries in the regional DNS
  - Regional entity provides Tracking Area to SGW mapping
  - Regional entity provides Cell Identifier to Tracking Area mapping

eNB Identifiers





E-UTRAN Cell Global Identifier (ECGI)

E-UTRAN Cell Identifier (ECI)

ECI

Macro - **Short (20bits) eNB-Id**, 256 cells
Home eNB - Long (28 bits) eNB-Id, 1 cell

eNB Identifier (eNB-Id)
eNB in most significant bits, Cell Id in least significant bits

- eNB-ID's to distribute = 1,048,575
- **Suggest ID's be distributed in blocks of 50**
  - **Do not need to be contiguous but handing out blocks may be simpler**
- Estimate less than 60K eNB's required to cover US

- Regional eNB Identifiers (range) assigned by national entity
  - ECGI assignment to a specific location and hardware provided by regional entity

Regional DNS

- Region is responsible for setting up and hosting DNS
- Entries reflect hosts in region and are based on the ID's distributed to the region
- Entries include:
  - **TAI** to SGW Mapping
  - **APN** to PGW Mapping
  - SGW/PGW Collocation information
  - **TAI** to **MMEG** mapping
  - **MMEG** to MME host mapping

Topic for further study - Roaming

- Ownership of commercial carrier roaming agreements
  - National or regional entities?
- Roaming inter-connect (IPX and DCH/FCH)
  - National or regional level?
- Billing infrastructure
  - Centralized or distributed?

Topic for further study - Regional DRA

- Host mapping control in the region?
- Use a separate realm or be part of the national realm?
- Migration when national realm and DRA's are available

Topic for further study - Routing Domains

- Partitioning Routing Domains
- Bridging Routing Domain Partitions
  - National to Regional
  - Regional to Regional

Thank You

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